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# EDITORIAL

## Water Pollution Research

WITH the march of civilized life there comes ever greater insistence on the controlled purity of man's daily material needs, and with the quick-ing of the pulse of industry there comes an inevitable k to life and health. Long before we knew anything out *Bacillus coli* or albuminoid ammonia we were taught drink with circumspection: and before long we all have to use, and perhaps to drink, what water can get. For the available sources of unpolluted ter are gradually being depleted, and many rivers ich are to some extent polluted will have to be lized in the future as sources of supply, after treat-nt, to meet the increasing domestic and industrial quirements. The twin problems of prevention and re of pollution are in the care of the Water Pollution search Board, whose report (H.M.S.O., 1s. net) the year ended June 30, 1932, was published a ort time ago. It stands to reason that since the flow a river varies with the rainfall, the condition of that ter supply cannot be regarded as satisfactory unless maximum effect of the effluents it receives is not great as to represent serious pollution even in unusu-y dry periods. In point of fact, however, long etches of the rivers flowing through industrial and nsely populated areas are badly polluted even at nes of flow greater than the average. It is clear, erefore, that much more stringent conditions should vern the discharge of effluents into rivers from which pplies are drawn for domestic and similar purposes. ch requirements need not necessarily involve an ditional charge on industry, for by suitable treatment ste water may be made usable, or even be made to ord products of value. The Board points out that difications of factory processes can frequently minish pollution, and refers to many instances in which unrestricted and uncontrolled discharge of polluting uids from one factory renders the water unfit, except er costly treatment, for use by adjacent factories. e way of diminishing industrial pollution of water pplies is to have a first-rate slump and a period of rough depression, but this method, which in some gree has been forced upon us of late, has the disadvan-ge that it also retards the rate at which information garding other methods can be collected and applied. ternatively, a co-operative study can be made of the ole problem, and means devised to provide the cessary safeguards with the least possible expenditure, with the greatest possible profit, as the case may be. nong the investigations in progress are those con-ned with the effluent of beet sugar factories, which by adopting suitable methods of operation can now satisfactorily re-use all or most of the waste water, whilst any portion to be discharged can generally be purified by the process of biological filtration. The treatment of liquid wastes from dairies is a somewhat similar problem, which is being subjected to preliminary examination. The field and laboratory work relating to the scientific survey of the River Tees is now almost complete. The death of large numbers of fish in this river, previously attributed to lack of dissolved oxygen or to the presence of tar acids, has been traced to the presence of cyanides derived from coke ovens; the cyanide can be removed by treating the effluent with lime and spent pickle liquor, itself a waste product discharged into the river where, however, the ferrous chloride is oxidized and precipitated without affecting the cyanides. Other studies relate to the base-exchange process of water softening, to plumbo-solvent waters, and to sewage disposal, particularly the biology of the activated sludge process and the conditions which affect the quantity and nature of the colloids in sewage. Another valuable service rendered by the Board is the publication of monthly summaries of current literature dealing with water supplies, sewage, trade waste waters, river pollution, and kindred subjects.

## Jargon in Science

At the British Association Dr. Mortimer Wheeler has complained of the alarming growth of technical jargon. It is reported that the question is to be considered by the Education Section and a suggestion has been made that a so-called "basic English" making use of only about a thousand words would suffice for most scientific work. It seems that it is almost the duty of an editor of a scientific journal to express his views on such a question since the nature of his occupation so frequently brings the problem to his notice. A casual acquaintance with the elements of one or two other sciences convinces one such editor that what is true of chemistry in this respect is true of some other sciences. Chemists make use of a great many technical terms that the author and his chemical readers understand; they are accus-tomed to use these terms with the same precise meanings; they use them in chemical conversation with each other and they think in such terms. Generally the use of these terms saves a great deal of space in writing or printing and a great deal of time in lecturing or talking. The disadvantages of the use of such terms or "jargon" are that the general public does not understand them and that some young students who are quite familiar with them do not really know what the terms mean

and are incapable of translating them into plain English: in some cases the use of such terms is a smoke-screen successfully concealing the ignorance of the speaker. It is astonishing how difficult it is to write accurately *in plain English about chemical matters and part of the* difficulty arises from the fact that the attempt brings *one up so frequently to the point where one's knowledge* and one's ignorance meet. This point is easily slurred over by the use of long Greek or Latin words. A chemist who attempts to describe in plain English the modern transmutation of the elements will easily find examples of this difficulty. Colloid chemistry provides other instances. It seems to us that it would be a great waste of time for a chemist, in writing articles to be read by other chemists, to restrict himself to a vocabulary *of a thousand, or five thousand words*: let him use any words he knows that explain his meaning exactly and *invent new words if he chooses for things that he can* explain accurately or things that he does not know and cannot explain accurately. Life is too full to enable us to dispense with such scientific shorthand. On the other hand it seems to us that many chemical articles and treatises make a far greater use of chemical jargon than is necessary and that it is a very valuable piece of discipline to try, now and then, to write a chemical article in plain English. Chemical technical terms are like examinations; they are necessary but they can be overdone: too great importance is attached to them. *Many chemists can neither write nor speak on chemical* subjects in plain English: this is deplorable and it helps to widen the gap, already wide enough, that separates the scientific man from the intelligent public that is not scientific. The continued use of chemical jargon also tends to make the scientific man prefer to use long words when short ones are available; some of them cannot say that a man got a chill and caught a cold: they prefer causation to cause; they do not say that a watch doesn't go, but that it has ceased functioning; they hate to say the best conditions of an experi*ment are such a temperature and such a pressure*: it seems more learned to say the optimum conditions. The use of long and learned words is often convenient and proper; we have no sympathy with the wish to use long and learned words, when short and familiar ones are ready at hand.

## Oil Films

It has been raining all night and indeed all yesterday too, and although no doubt every drop is worth millions to the farmers, this is poor consolation for a chemist who for the nonce is on holiday. Our training is such we are constrained to find interest in everything as well as sermons in stones, and the latter sentiment is happily appropriate to the place from which we write, where the softer beds in the lias may be torn apart like the leaves of a book disclosing imprints of ammonites and other fossilized relics of a past age. We have been watching the rain fall on the waterproofed surface of the high street and trickle into the gutter, washing down with it the oil splashes which have fallen from passing automobiles. As a consequence the trickle in the runnel carries on its surface a thin film of hydrocarbon oil spread out in a monomolecular lay[er] the manner with which the researches of Hardy, Adam and Langmuir among others have made acquainted. The nature of the hydrocarbon makes film relatively long-lived for it is not subject to o[xid]ation: so that with the spread of motoring we m[ay] contemplate streams and rivers and even the becoming coated on its surface with an oil film. Ri[ght] out at sea the track of a steamer is left plainly obvi[ous] being marked by a broad oil streak which persists days in calm weather. This is even visible in Mediterranean, where the traffic is continuous, and very definite in coastal waters. It is conceivable the effect of this oil film may in time become far-reach[ing] for it will destroy those organisms which flourish at surface of the water, those which in the sea are ter[med] plankton. At present we are vague in our compre[hen]sion of what service these may be to man, but ther[e is] more than a hint that some of the essential vitamins manufactured by the plankton and pass by stages f[rom] it into the liver oil of the larger fishes. In view of knowledge that so many of the vital reactions in the take place at surfaces where several phases come i[nto] contact, chemists will be willing to attach extr[a] importance to the reactions which occur at the surf[ace] either of the placid pond, the running brook, or surging sea, and view with alarm their restriction prevention owing to the presence of a film of hy[dro]carbon oil. This oil film from road and garage i[s a] wider and more subtle source of water pollution t[han] that of the discharge of oil waste from steamers near coast, with the disastrous effect on sea-birds to wh[ich] the press so often makes reference in vain. The coa[st] discharge is readily preventable by legislation should be forbidden whereas the inland pollut[ion] cannot be so restricted. It may be that we are o[ver] stressing its importance but its influence needs watch[ing] and motorists as a class should at least be instruc[ted] how to dispose of their discarded oil.

## Lead-lined Plant and Chemical Stoneware

We publish this week an important memorand[um] prepared by the British Chemical Plant Manufactur[ers'] Association which is interesting for many reas[ons] including the advantage derived from co-operat[ion] between that Association and the Association of Bri[tish] Chemical Manufacturers. The Official Directory of Plant Manufacturers' Association contains the na[mes] of many manufacturers of acid-resisting linings, Can[...] Iron Foundries, T. & C. Clark & Co., G. A. Harvey & [Co.], the Kestner Evaporator Co., Oxley Engineering [Co.], Prodorite Ltd., Thompson Bros. (Bilston), Ltd., [and] John Thompson (Dudley), Ltd., but only one stonew[are] firm, the Hathern Station Brick & Terra Cotta Co., L[td.] We have heard that this last-mentioned firm has m[ade] great progress in chemical stoneware during the [last] two or three years; probably there are other fi[rms] that have also made developments in this direct[ion] but people are apt to turn to the easiest and m[ost] accessible list for their needs, and the Official Direct[ory] is certainly one.

# PLASTICS: THEIR USE IN THE ELECTRICAL INDUSTRY*

**By LT.-COL. K. G. MAXWELL, M.I.E.E.**

The initial difficulty in presenting a balanced survey of the extent to which plastics have already been applied in the electrical industry is that the manufacturer has made use of these valuable materials in many cases where their presence is hardly discernible in the finished plant and equipment. In order to deal with this difficulty, I have divided our subject into the following four main headings:

(1) General examples of plant and machinery where plastics are used.

(2) The needs of the electrical engineer.

(3) Essential properties of plastics found to be of satisfactory use in the electrical industry.

(4) Schedule of uses of plastics in the electrical industry.

In dealing with this subject I am accepting the general definition of plastics given at the time of the formation of the Plastics Group, namely: Synthetic and natural resins, rubber, casein, bitumen and asphalt compositions, cellulose esters and ethers, and all allied products and derivatives. These names and terms, however, hardly appear recognizable as indicating the manufactured products made directly from plastic materials used in the various branches of the electrical industry. The general public, on examining any installation of generating, transforming, or transmission plant or equipment, either in a modern power house or on the countryside in the form of outdoor transforming or distribution stations, would hardly be able to detect any trace of the essential plastic materials which have been incorporated in so many important parts of the manufactured plant.

## General Examples of Plant and Machinery

In order to establish the connexion between the plastic material as defined above and its uses in the electrical industry, the following are selected as representative examples of equipment parts of which are constructed from plastics: High-pressure turbo-alternators, stator windings for alternators, turbo-alternator bars, shell-type transformers, transformer tap changing gear, core-type step-up transformers, off-circuit transformer tapping switches, condenser-type bushings, outdoor-type bushings, ironclad busbar transfer switches, traction circuit breakers, arc chutes for magnetic blow-out, and the power arc in the High-Voltage Laboratory.

## The Needs of the Electrical Engineer

In dealing with the needs of the electrical engineer, the first consideration is one dealing with the reliability of any material employed. This naturally assumes a very serious aspect when large equipments have to be maintained in running order. It is for this reason that a scrutiny of the materials is exceptionally severe when dealing with heavy plant, as for instance, the generating equipment installed in the large power station already shown.

With heavy plant, mechanical stresses are involved which, though kept within safe designed working stresses, are imposed under elevated temperatures normally of the order of 100° C., and at all times under service conditions the physical properties of the plastic material used must resist distortion or fatigue in its particular use. For instance, synthetic resin sheets used as segmental tooth supports have to give mechanical stability to the laminations in stator or rotor and to resist fracture from shock or sudden impact under stresses consequent upon the severest conditions of electrical service. Lengthy use at running temperatures must not cause loss of shape or shrinkage and freedom from atmospheric and moisture effects must be ensured.

In another case where plastic material used with mica for bonding and insulation purposes respectively is incorporated in the conductor insulation of these large machines, the permanent condition of the composite material in service must be such that the electrical properties can be maintained in the presence of definite mechanical stresses, repeated under service conditions due to the cycle of starting from cold running up to normal running temperatures, stopping and cooling of the machine.

Again, a moulding used for both mechanical and electrical purposes, when once formed must permanently retain its shape and suffer no shrinkage, be immune from fracture caused by sudden impact and still retain its insulating properties through the mass and over the surface under all conditions of service. With light plant, although in this case a failure may not result in very serious dislocation over a large area of electrical supply, it may still cause cessation of operation of the plant itself.

A small, almost insignificant piece of apparatus may actually control a large generator and, therefore, the reliability of a whole power station may be influenced by the performance of a small moulded article. The same rigid scrutiny of raw materials and processes in using plastic materials is therefore essential to obtain the resultant satisfactory physical and electrical properties

Electrical accessories embrace the greatest volume of plastics in their production in a multitude of forms ranging from elaborate artistic bracket fittings or stand lamps to the smallest form of lamp holder or to an eyelet for flexible leads. In this field artistic effect often plays as great a part in design and preparation as the electrical and mechanical properties. The general requirements for these parts have been covered by the recently issued British Standards Specification No. 488 for Moulded Insulating Materials, but even this Specification does not yet deal with arc-resisting mouldings or those capable of operating at temperatures exceeding 140° C.

## Essential Properties of Plastics for the Electrical Industry

The engineer's use of plastics must always depend upon obtaining the essential property or properties for the particular use in question. A list of these properties, any one or more of which may be the essential feature, includes: (1) the plastic yield of a material under the influence of heat; (2) the plastic yield of a material under the influence of stress; (3) the ability of a material

* Lecture given at the Science Museum, South Kensington, Wednesday, June 28, 1933.

to withstand certain electrical stresses when in a hot or cold condition : (4) the influence of excessive humidity on the electrical strength values, either on the surface or through the material : (5) the effect of sudden impact ; (6) the ability to withstand twisting or tensile stresses : (7) the ability to withstand fire risks, and the possible self-extinguishing properties associated with the material when once ignited : (8) the ability to withstand heat of the intensity of an electric arc.

In many cases the effect of acidity, alkalinity, immersion in hot water, or hot insulating oil has also to be known. These properties have also to be studied in their relation to : (*a*) new material as purchased on the open market ready for working into some portion of electrical equipment : (*b*) the same treated material after it has withstood lengthy service conditions.

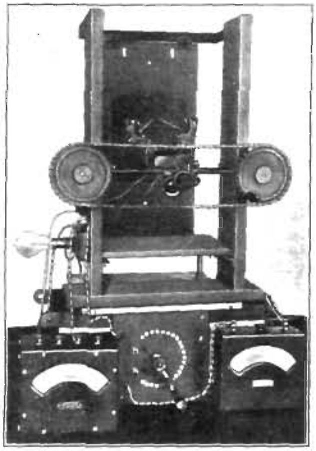


Fig. 1

*Carbon arc penetration tester for arc-resisting materials*

A *definite classification* of all mouldings is essential and is one of the immediate responsibilities of all those who on one side develop and manufacture plastics in their various forms and on the other side design the particular form in which the plastic is to be applied, as, for instance, in the heavy plant, light plant, and accessories already referred to. Those countries which have already adopted classification systems are to-day reaping the benefit.

Unfortunately in this country the lack until this year of any recognized classification of mouldings for the electrical industry, has made the task of classifying the essential plastics for that industry harder, owing to the rapid introduction of new types of otherwise attractive plastic materials.

To complete the standardizing of plastics for electrical purposes, every endeavour is being made the laboratories of firms interested in their use to evo[lve] a number of clearly defined tests which will reveal t[he]

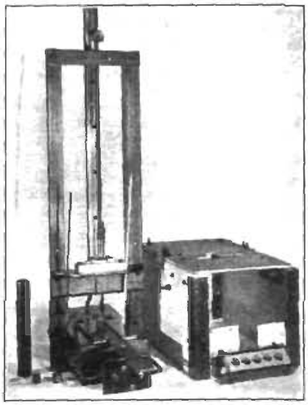


Fig. 2

*Vertical tube impact tester for bitumen and other plastics*

characteristics essential for any particular use. A[n] instance of this development is the carbon arc penetra[-] tion tester now adopted by the E.R.A. in the dra[ft] form of the proposed British Standards Specificatio[n] for non-ignitable or self-extinguishing boards. It w[ill] be realized that materials which have to withstand th[e]

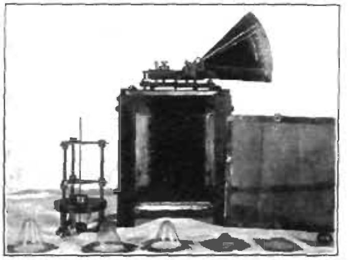


Fig. 3

*Softening point tester for cellulose and other films*

heat generated between the carbon electrodes a[re] intended for exceedingly severe temperature condition[s].

The behaviour of a material under impact may [be] studied by a number of different methods, but perha[ps]

TABLE I

*General characteristics of electrical mouldings*

| Grade | Colour | Base | Max. temp. | Tensile, lb./sq. in. | Cross breaking | Elec. str. thick (in.) | v./m. | Water abs. 24 hrs. | Service |
|---|---|---|---|---|---|---|---|---|---|
| …rmal …mperature | Black … | Pitch and wax mixtures | 30° C. | 1450 | 2900 | 0·25 | 100 | 0·14 | Terminal blocks |
| | Brown … | | 30° C. | | | | | | |
| …derate …mperature | Brown … | Shellac or rubber and selec. fillers | 60° C. | 2300 | 5000 | 0·27 | 300 | 0·21 | Magneto distributors |
| | | | 60° C. | 2300 | 5500 | 0·092 | 300 | 0·2 | |
| … conditions | Black … | Synthetic resin with various fillers | 120° C. | 7900 | 10500 | 0·166 | 175 | · | High-voltage mouldings |
| | Black or brown | | 110° C. | 8300 | 8750 | 0·113 | 220 | — | |
| | Black | | 110° C. | — | 7946 | 0·126 | 84 | 0·3 | General purposes |
| | Mottled | | 110° C. | 9300 | 12000 | 0·125 | 75 | — | Shock-proof |
| | Brown | | 105° C. | 6600 | 7500 | 0·118 | 100 | 0·3 | Cheap mouldings |
| | Black | | 90° C. | 7100 | 6700 | 0·118 | 90 | 0·3 | |
| …t-resisting | Grey | Mycalex … | 400° C. | 7000 | 9300 | 0·5 | 240 | 0·7 | High-frequency radio |
| …meproof | Brown | Treated hydraulic cement | 500° C. | 1000 | 2400 | 0·5 | 30 | 5 | Barrier pieces |
| … resisting | White | Hydraulic cement | Red heat | 1000 | 2400 | 0·5 | 10 | 14—20 | Arc chutes etc. |

*Specimens for moderate temperatures and normal temperatures are tested at 20° C.*
Specimens for hot conditions are tested at 90° C.
Specimens for heat-resisting, flameproof, and arc resisting are tested at 180° C.

…he simplest type of apparatus just produced for this …ork at any given temperature consists of a long tube …own which is allowed to drop a weight from any …elected height. The failure by deformation or fracture …f a standard specimen under this impact can be regis…ered either as the height necessary to cause failure or …n terms of energy dissipated at selected velocity of …mpact determined by the height.

Another example when using cellulose or allied films …r sheet for insulating material is the determination of …ow point under various temperature conditions. A suitable piece of equipment has been devised and may …ecome accepted as standard for this purpose. This …rincipally depends upon the distention of the material …t gradually rising temperatures under the weight of a …eel ball provided with means of external measurement.

These three examples, all of which have been developed in the Research Laboratories of the Metropolitan-Vickers Electrical Co., Ltd., are shown in Figs. 1, 2, and 3.

Broadly speaking, a general classification governing the use of plastics for electrical engineering purposes may be indicated as follows:

*Plastics for normal temperature conditions.* (*Max. temp.* 30° C.)—A large variety of plastics may be selected for this purpose owing to the elimination of practically all temperature conditions, and in consequence the selection of a suitable material will only have to depend on one of the following features, mechanical strength, electrical characteristics, and artistic value.

*Plastics for moderate temperature conditions.* (*Max. temp.* 60° C.)—The fact that a temperature higher than

TABLE II

PRINCIPAL PLASTICS USED IN THE ELECTRICAL INDUSTRY

| Base | Form or product | Typical applications |
|---|---|---|
| | *Natural group* | |
| …ellac … | Bonding varnish | Shellac bonded paper boards, tubes, cylinders, and high-voltage bushings |
| | Moulding mixtures | Low-temperature non-tracking mouldings |
| …ubber … | Tape, sheets, tubes | Insulated wires, cables, flexibles, bus bars, and guard rails; insulating mats, gloves, panels |
| | Moulding mixtures | Moulded accumulator cells, magneto distributors, liquid starter tanks |
| …tumen … | Filling, impregnating, and sealing compounds | Impregnation of coils, filling of ironclad gear, and high-voltage bushings; sealing of cables |
| | Moulding mixtures | Moulded low-temperature terminal blocks |
| W…x … | Waterproof seals | Moisture protective coatings |
| | Moulding mixtures | Low-temperature mouldings |
| | *Synthetic group* | |
| …nol formaldehyde | Resins, bonding and treating varnishes | Synthetic resin bonded paper or fabric boards, tubes, and cylinders |
| | Moulding powders | Moulded insulators, links, barriers, terminal boards, frames, cases, dials, and handles |
| …a formaldehyde | Bonding and impregnating varnishes | Transparent and opaque signs, name and diagram plates. |
| | Moulding powders | Instrument cases |
| …ptal … | Resins, varnishes | Heat-resisting mica sheet, oil-resisting gaskets |
| …ulose … | Varnish, sheet, tape … | Motor, armature, and stator coil insulation; slot cell, cable, and conductor coverings; insulating sheaths |
| …sein … | Rods, sheets, and tubes | Insulating screws or studs, switchboard labels, cable-identification rings |

*normal has now to be catered for immediately results in the elimination of a number of plastics made from low melting point components, such as those employing waxes, pitches, shellacs, etc. Under this classification the performance of a plastic is complicated by the consideration of its stability at the maximum temperature contemplated, and for this reason the softening point figures associated with Prof. Marten's softening point tester begin to call for attention.*

*Plastics for hot conditions. (90°–120° C.)*—Any insulation employed actively on an electrical apparatus must retain perfect reliability at the maximum temperature specified, and since the maximum output of an electrical equipment is limited by the permissible temperature rise, the temperature condition now assumes very considerable importance. A scrutiny of the plastics available soon reveals that the number which can be used under these conditions has now become limited, resulting from the elimination of practically all of those employing waxes, pitches, and even rubber. Some of the low-grade synthetic resins will also fail under the temperature conditions now imposed, and in consequence the designer must use higher-grade mouldings—most of which contain selected synthetic resins.

*Heat-resisting mouldings. (Approx. 300° C.)*—Materials classified under this heading refer to most of those used with domestic utensils, such as electric irons, kettles, power plugs, adapters, lamp sockets, and radiator fittings. The heat associated with the use of these mouldings is generally the result of close contact with the source of heat or the generation of undesirable heat due, for instance, to the difficulty of ensuring good electrical contact in the case of a power plug. The selection of plastics suitable for this purpose is limited almost entirely to a few of the high-grade synthetic resin mixtures specially manufactured for this work, into which is incorporated a high percentage of inert filler, such as mica, asbestos, or possibly slate and marble powders. Where conditions are even more severe and the possibility of reaching a temperature of nearly 400° C. has to be contemplated, the lead borate and mica mixtures, such as Mycalex, fulfil a valuable requirement.

*Flame-proof mouldings. (Approx. 500° C.)*—Materials under this heading are similar to the arc-resisting mouldings but have been treated to give better electrical properties under humid conditions, thereby relinquishing their ability to resist carbonization in contact with an arc.

*Arc-resisting fireproof mouldings. (Red heat).*—This last classification caters for the severe conditions which are met with whenever power circuit breakers have to operate under full load conditions. The arc produced at the instant of breaking the circuit is excessively hot, and although numerous types of magnetic devices are employed so as to reduce the intensity and duration of the arcing period, extensive damage can be done in a fraction of a second unless these special arc-resisting materials are employed so as to confine the arc within the desired limits. Here we have a material which must not ignite, carbonize, and, if possible, must not melt.

There are many forms of classification of pla based on different properties, behaviour, or type of pl used for producing mouldings. Dr. W. T. Jenk for instance, has given a classification as follow Thermo plastic materials: (2) Thermo hardening ma rials: (3) Chemical hardening materials; (4) H temperature hardening ceramics.

*The general characteristics of mouldings standardi in accordance with the temperature classification I ha advocated and giving the main mechanical and electri properties are given in Table I.*

### SCHEDULE OF USES OF PLASTICS IN THE ELECTRIC INDUSTRY

This schedule (as shown in Table II) gives a list accepted electrical uses of plastics, divided broa into natural and synthetic groups and forms doc mentary evidence, if such were needed, of the great a important part played by plastics to-day in the electri industry.

I wish to acknowledge the kindness of Messrs. Bakeli Ltd. and The Micanite & Insulators Co., Ltd. for t use of certain illustrations and of the The Metropolita Vickers Electrical Co., Ltd. for the use of illustratio and data.

## THE CONVERSION OF A BILE ACID INTO HYDROCARBON DERIVED FROM 1 : 2-BENZANTHRACENE

By J. W. COOK and G. A. D. HASLEWOOD

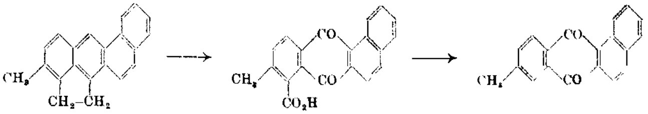
The dehydrogenation of dehydro*nor*cholene to hydrocarbon derived from 1 : 2-benzanthracene was for shadowed by one of us at a Discussion at the Roy Society on June 15, 1933 (Proc. Roy. Soc., B, 1933, 11 277), and we have now accomplished this transformatio Our experiments are as yet very incomplete, but t appearance of a paper by Wieland and Dane (Z. physi Chem., 1933, **219**, 240) describing the selenium dehydr genation of dehydro*nor*cholene makes it necessary publish this preliminary account.

In our selenium dehydrogenation experiment obtained not only a yellow hydrocarbon, evident identical with the "methylcholanthrene" of Wiela and Dane, but also a product crystallizing in colourle plates, m.p. 132—134°. The yellow hydrocarbon, purifi through its chocolate-brown picrate, m.p. 176—17 melted at 171—172° (Wieland and Dane give 174°).

The chief purpose of our investigation was to exami the possibility of conversion of a naturally occurri compound into a carcinogenic compound by sim reactions, for there is considerable probability that hydrocarbon having the structure of "methylch anthrene" (I) will be found to have cancer-produci properties. Dehydro*nor*cholene is formed from the bi acid, deoxycholic acid, by (*a*) oxidation, (*b*) reductio and (*c*) thermal dehydration and decarboxylation.

Proof of the structure of the aromatic hydrocarb corresponding with dehydro*nor*cholene will, moreov provide a useful contribution to the chemistry of t sterols and bile acids. For instance, as Wieland and Da have pointed out, the mere formation of such an aroma hydrocarbon furnishes chemical evidence, which w

…iously lacking, that the side chain of the sterols and …acids is attached in position 17 of the ring-system. …the dehydrogenation product of dehydro*nor*cholene …rrectly represented by formula I (apart from ultimate …lysis Wieland and Dane cite no evidence for this), …it should be capable of oxidation to 5-carboxy-…methyl-1 : 2-benzanthraquinone (II), which by de-…rboxylation should pass into 6-methyl-1 : 2-benz-…thraquinone (III):



I II III

Wieland and Dane were unable to isolate any definite product of oxidation of their "methylcholanthrene" with chromic acid or permanganate, but we found that our yellow hydrocarbon was smoothly oxidized by sodium dichromate in acetic acid to give an orange acid (m.p. *ca.* 270°) which was certainly an anthraquinone derivative for it gave the Liebermann anthraquinol reaction with zinc dust and alkali. When this acid was sublimed at 400° in an atmosphere of carbon dioxide, conditions under which 4-carboxy-1 : 2-benzanthraquinone is decarboxylated (Cook, J. Chem. Soc., 1931, 2527), it passed into an alkali-insoluble quinone which also gave the Liebermann colour reaction. This quinone, like many homologues of 1 : 2-benzanthraquinone prepared by one of us (J. Chem. Soc., 1932, 456), formed orange-yellow needles which gave a dark green solution in concentrated sulphuric acid. The quinone has not yet been completely purified on account of the small amount so far available, but the sample which we obtained had m.p. 229°, after sintering, whereas 6-methyl-1 : 2-benzanthraquinone melts at 174°. It thus appears that the structure (I) for the yellow dehydrogenation product of dehydro*nor*cholene cannot be correct, although the compound undoubtedly has this *type of structure*.

The colourless dehydrogenation product which we also isolated was not oxidized to a quinone and hence was probably incompletely dehydrogenated.

The above experiments were carried out with 1 gram of dehydro*nor*cholene. We now have 20 grams of this hydrocarbon, the preparation of which is very tedious although not difficult, and we propose to make a complete study of the structures of its dehydrogenation products.

Research Institute,
The Cancer Hospital (Free),
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## LEAD-LINED PLANT AND CHEMICAL STONEWARE

All who are interested in the British chemical plant industry will be gratified to hear the result of an investigation which has recently been made by the British Chemical Plant Manufacturers' Association in regard to the capabilities of British firms to supply products which compare favourably with the best obtainable from foreign sources.

In a letter to the technical press at the beginning of 1932, the Secretary of the British Chemical Plant Manufacturers' Association, in advocating a "Buy British" policy, stated that "speaking generally there is little if any need for users of chemical plant to go abroad for their requirements." This statement was challenged by a "chemical manufacturer" (name not given) who complained regarding the unsatisfactory nature of the lead-lined plant and chemical stoneware obtained from British firms. His criticisms pertained mainly to the homogeneous type of lead lining and to the ineffective keying of the lead to the plant, while in the case of chemical stoneware he alleged that the British makers laid too great reliance on the glaze for the desired quality of acid resistance and imperviousness, and did not pay sufficient attention to the selection of the stoneware body.

The ensuing letters from firms engaged in the production of lead linings and stoneware might have been regarded as sufficient to disprove the above contentions, but since they could all be challenged as *ex parte*, the British Chemical Plant Manufacturers' Association decided to investigate the whole subject. Through the intermediary of the Association of British Chemical Manufacturers, the views of chemical manufacturers who were actual users of British lead-lined plant and chemical stoneware were collected and subsequently a joint meeting of makers and users in the two associations was convened to consider the collated observations. A frank exchange of views took place which both parties admitted to be of great value in indicating how, by closer co-operation in the design and supply of the plant, difficulties which had arisen in the past could be overcome.

*Lead linings.*—As regards lead linings, it was agreed that trouble had arisen owing to poor application of the lining on the plant made some years ago when the process of homogeneous lining was new in this country, but that great progress had been made in recent years, and there were now a number of firms capable of supplying linings equal to the best foreign product. There should, in modern plant, be no possibility of liquid penetrating between the liniug and the outer casting. Emphasis was laid on the point that sheet lead attached to a vessel does not constitute homogeneous lead lining. Pin-holes are a likely cause of trouble; while generally speaking they should not exist in the most modern linings, it would nevertheless be a wise precaution for users of new homogeneously lead-lined plant to examine the lining minutely after the plant has been in operation for a period with a view to detecting and repairing internal pin-holes which could not have been detected on the unused plant but which had worked through to the surface during use.

The discussion revealed a lack of readily available data on the heat conductivity of various constructional materials and in particular of different types of linings, and it was suggested that steps be taken to remedy this defect. Criticisms which have sometimes been made regarding the poor heat conductivity of lead-lined plant as compared with plant in iron or steel have failed to appreciate that this is a necessary corollary to the intrinsic heat conductivity of lead.

Makers and users agreed that when a homogeneously lined unit was required, it should be designed from the commencement with this aim in view, namely that it was to be lined. The parts which would prove difficult to line could then be eliminated or modified. It was essential that all surfaces should be rubbed down to a high degree of smoothness before the lining process was commenced. The inadvisability of introducing riveting into a vessel which was to be lead lined was also emphasized. For these reasons the plant manufacturers urged the users to approach them when the plant was in the design stage and let them suggest where modification might be introduced to make the lining procedure easier and therefore more satisfactory.

On a question raised as to the comparative value of spraying, the opinion was expressed that by the very nature of the process the lead lost some of its valuable characteristics in that spraying yielded layers of lead particles instead of a solid mass of lead. Spraying was adjudged to be excellent in use as a type of paint, but for the internal lining of chemical plant, where corrosive products were used, it could not be expected to give as satisfactory results as a lead lining on account of porosity. This limitation should be recognized.

As regards the maximum temperature at which homogeneously lead-lined plant could operate safely, one manufacturer stated that he had built reaction vessels which were working regularly at 260° C., but another recommended 230° C. as the maximum safe temperature since lead "doughs" at 250° C. At high temperatures pure lead often fails mechanically and requires watching.

The question of the supply of homogeneously lead-lined coils received attention, and one manufacturer exhibited photographs of grid type heaters in homogeneously lead-lined metal which were proving satisfactory. Another manufacturer admitted that he could not give an unqualified guarantee in respect of lead-lined coils proper when used at elevated temperatures and in the presence of corrosive materials; on the other hand, such coils were as good as lead piping under these conditions while at the same time being stronger.

The main conclusion reached was that homogeneously lead-lined plant could now be produced as satisfactorily in this country as anywhere, while the main recommendations were (*a*) that the users should co-operate with the makers at an early stage in the preparation of the design, and (*b*) that the plant manufacturers should collaborate in the preparation and issue of data on the mechanical, conductive, and other properties which would be helpful to the users who were considering the employment and design of homogeneously lead-lined plant.

*Chemical stoneware.*—The position in regard to chemical stoneware has changed enormously in the course of the last 18 months owing to the progressive action of one or two firms who have taken the subject up on scientific lines. Practically any type of chemical stoneware can now be obtained in this country and those users who were in close touch with recent developments and have tested the latest British products, were agreed that they were in no way inferior to the best foreign stoneware. In regard to heating up the stoneware, which must always be done with great care since brittleness is a characteristic inherent in all stoneware, it is claimed that in many respects the British product is superior to the foreign, and that if appropriate lagging is provided and the heating is done slowly, it is possible to reach and maintain a temperature of 220° C. The only deficiency is in regard to stoneware pumps where the makers have wisely deferred putting a pump on the market until they were confident of its success. It is not anticipated that it will be long before a satisfactory stoneware pump of British manufacture is available.

Mention was made of foreign propaganda to the effect that it would never be possible to get good British stoneware because manufacturers in this country had not suppplies of the proper clay available. This is not the case. As the manufacturers pointed out, the raw material for a piece of chemical stoneware has to be collected from various parts of the world and blended, and all of these sources are equally available to British as to foreign makers. Indeed certain of the foreign manufacturers have to come to England for supplies of some of the materials they require.

The makers admitted the criticism that the British product compares unfavourably with the foreign in its finish, but contended that the appearance of the glaze on chemical stoneware had no real significance; the glaze did not make the vessel non-porous; in fact, the glaze was frequently more porous than the stoneware itself, and the porosity test was a better guide to the user than the appearance of the glaze. Furthermore many of the highly finished foreign units contained objectionable amounts of iron in the glaze layer. As in many other cases it is difficult to teach the British user that performance and not appearance is what really matters. Unfortunately if a vessel is well finished, the tendency, if it fails, is for the user to say that it was good any way to start with and that the failure was probably his own fault. In the case of failures in British plant, the complaint has invariably been against the manufacturer without adequate recognition that the manner of operating the plant may have been the cause.

The effect of porosity was emphasized and it was submitted that most troubles were due to the use of a too porous grade for the purpose to which a unit was put. Chemical stoneware should in no case have a porosity greater than 1% and a much lower figure could be obtained when necessary.

As in the case of lead linings, the makers urged the need for more co-operation and consultation with the users in the design of the plant if the best results were to be achieved.

The main conclusion was that the British makers of chemical stoneware had made great progress in the last

ar or so, and that there was every hope that in the near future this country would be able to meet all requirements. The main recommendations were (*a*) that the British Standards Institution should be asked to undertake the standardization of stoneware sockets and tapered flanges, and (*b*) that the standardization of the terms used for the designation of the properties of stoneware and the tests to be used in the determination of these properties should also be undertaken.

As an outcome of the above recommendation a strong committee of the British Standards Institution is now being appointed under the able chairmanship of Mr. J. Arthur Reavell, to investigate the standardization of items and tests in question.

The British Chemical Plant Manufacturers' Association and the Association of British Chemical Manufacturers are so satisfied with the outcome of this investigation and the frank discussion between makers and users, that they propose to apply this procedure to any similar problems that may arise in future.

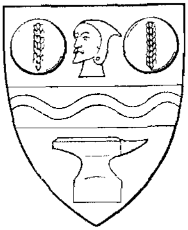
## DARTFORD'S CHARTER

Dartford is well known to the trade as the mother-town of many British fine chemicals. On September 13 this Kentish town, whose origin dates back to pre-Roman times, celebrated the achievement of its ambition and became a borough.

Its chief industries to-day are engineering, milling, paper-making, and the Wellcome Chemical Works which were established on the site of the old Phoenix Mills in 1889. The history of these mills carries back to 1649 and embraces that of many of the old industries of Dartford including ironwork, cotton spinning, corn-grinding, mustard making, engineering, and paper-making. None, however, has prospered like the industry built up by Burroughs Wellcome & Co. Of course, all the old buildings have disappeared and in their place have arisen modern buildings perfectly equipped and designed for their specific purpose and the estate now embraces Temple Hill and the adjoining 200 odd acres of land.

The growth and prosperity of the Wellcome Chemical Works have been of material benefit to Dartford: their achievements in pioneer production of fine chemicals, alkaloids, etc. have given it world-wide repute. So far back as 1900 a complete investigation of the alkaloids of jaborandi enabled Burroughs Wellcome & Co. to present pilocarpine nitrate in an ultimate state of purity, a fact which was guaranteed by the melting point being stated on each package. The standard then set for the melting point of this salt was adopted for the British Pharmacopœia 14 years later. Similar researches resulted in the issue from 1902 to 1905 of the mydriatic alkaloids, atropine, hyoscyamine, hyoscine, and homatropine in a state of purity. As another noteworthy instance of pioneer work may be mentioned an investigation of the alkaloids of Calabar bean, and the issue, in 1902, from the Wellcome Chemical Works of physostigmine (eserine) and its important salts, sulphate, hydrobromide, and salicylate, in a perfect condition of chemical purity. A development which followed a little later was the elucidation of the chemistry of the alkaloids of ipecacuanha and the production and issue of salts of emetine, for the first time, in 1904, in a state of complete purity, free from the accompanying alkaloids of ipecacuanha, cephaëline, and psychotrine. Further, the establishment of the constitutional relationship between emetine and cephaëline in the Experimental Department of the Wellcome Chemical Works led to the production at Dartford of emetine from cephaëline.

Prior to the war the Wellcome Chemical Works also took a prominent part in the solution of the problem of ergot which had baffled investigators for many years. Its complete solution was achieved by collaboration between the Dartford chemists and investigators at the Wellcome Physiological Research Laboratories. The work dates from 1906, with the discovery of the alkaloid ergotoxine and the issue of a reliable ergot preparation known as "Ernutin." The latest development took place in 1926 when a new salt, pure ergotoxine ethanesulphonate, was prepared and was considered of such importance by the British Pharmacopœial authorities that at their request Burroughs Wellcome & Co. gave up their patent rights in order that the fine chemical they had invented might be included in the British Pharmacopœia 1932.



The outbreak of war ushered in a period of great chemical activity. The German sources of many essential fine chemicals were closed to British soldiers, sailors, and civilians, and Dartford responded nobly to the call.

Soon after hostilities began the first British salvarsan known as "Kharsivan" was issued on a commercial scale. Many synthetic chemicals and similar medicinal agents previously supplied by enemy countries were soon in full commercial production at Dartford.

The present year has seen the discovery at the Wellcome Chemical Works of a new digitalis glucoside and its issue under the name Digoxin. This pure crystalline glucoside, isolated from the leaves of *Digitalis lanata*, is stable and provides a digitalis preparation of constant activity requiring no biological standardization.

The position in the fine chemical industry attained by Dartford before and during the war has been more than retained during these ensuing years of peace, and to-day when Dartford has gained her charter she may feel pride also in being the mother-town of so many aids to humanity in the form of fine medicinal preparations and by the prominent part she played in the re-establishment of the fine chemical industry in Great Britain.

The coat of arms granted to the Borough of Dartford by the College of Arms under the Royal Charter indicates

the industries for which the borough is famous. Engineering is typified by a golden anvil, papermaking by a jester in his "foolscap," milling by ears of wheat charged on two golden rondels which, as the College puts it, are as near to the familiar "tabloid" products of the Wellcome Chemical Works as heraldry permits.

## SHIPPING, ENGINEERING, AND MACHINERY EXHIBITION

The Society of Chemical Industry was specially invited to attend the Exhibition at Olympia on Saturday the 16th inst. and the members of Council were invited to lunch; among those who were present were the president, Dr. J. T. Dunn, two past-presidents, Prof. G. T. Morgan and Dr. E. F. Armstrong, Dr. Jordan, Mr. Craggs, and some others. Mr. F. W. Bridges, the organizer and general manager of the Exhibition, received the numerous guests and presided at the lunch and made such brief speeches as were appropriate to the occasion; Dr. Dunn was one of those who on behalf of the guests thanked Mr. Bridges for his hospitality and welcome. Ladies are now taking a more prominent part in engineering than they did formerly and several members of the Electrical Association for Women and of the Women's Engineering Society were present.

The Exhibition is well worth a visit for shipping engineering is so wide a subject as to interest a great variety of engineers, physicists, chemists, as well as the public at large. A striking exhibit is that of Sir W. G. Armstrong, Whitworth & Co., including a new Diesel railway locomotive; the General Post Office and the Marconi Co. show many wireless devices. Among the general engineering exhibits we were attracted by those of J. Stone & Co. including various H-R gears, Davey, Paxman & Co., C. A. Parsons & Co., Siemens Bros. & Co., and the Yorkshire Copper Works. The United Water Softeners show their now familiar and efficient plant, John Thompson, Ltd. show acid-resisting plant, Barr & Stroud have a good display of range finding apparatus. The Department of Scientific and Industrial Research, including the National Physical Laboratory, the Fuel Research Station, and the Chemical Research Laboratory, has a fine exhibit including a great many specimens illustrating research on corrosion. Other visitors found objects of interest in the exhibits of S. G. Brown, the Stream-line Filter Co., Ozonair, and Norton & Gregory, Ltd., and few could visit the Exhibition without obtaining instruction and pleasure.

### EXHIBITION OF PLASTICS AT THE SCIENCE MUSEUM, SOUTH KENSINGTON

The Exhibition, in the arrangement of which the Plastics Group of the Society has played so prominent a part, is drawing to its close. Those who have not used this opportunity of becoming acquainted with the progress the plastics industry is making are strongly recommended to pay a visit before the end of the month. On Thursday, September 28, the Institute of the Plastics Industry is arranging a public lecture by Mr. W. Owen Griffiths on "Plastics Plant and Equipment." The lecture will be given in the theatre on the ground floor at 6 p.m. There is, of course, no charge for admission, and no necessity for a special invitation.

## SIR HENRY FOWLER, K.B.E.

The Autumn Meeting of the Institute of Metals this week celebrated the silver jubilee of the Institute, and no more appropriate choice for the presidency could have been made than Sir Henry Fowler. The Institute was founded in Birmingham, and its meeting this week has been held there; it was in this city that Sir Henry received his early training, and he has lived and worked for many years in the Midlands. The Institute too could have chosen no man of greater experience, for there are very few engineering societies in this country of which Sir Henry has not been president at one time or another.

Sir Henry was born in 1871. He was educated at Evesham, and then proceeded to the Mason Science College, now the University of Birmingham. Then came an apprenticeship in the locomotive works of the Lancashire and Yorkshire Railway at Horwich, where also he gained experience in the test office. In 1900 he joined the staff of the Midland Railway Co. at Derby, and here may be said to have begun the career which has brought him so much eminence. By 1910 he had become chief mechanical engineer of this railway, a position he held until 1923, when on the amalgamation of railways in that year he was appointed deputy chief mechanical engineer of the L.M.S. Railway. Two years later he became chief mechanical engineer; in 1931 he relinquished this post to become assistant to the vice-president for research and development, retiring from this post in January last. Some of his most notable

work was concerned with the design of many standard locomotives, including those of the well-known "Royal Scot" class. He was also responsible for much work in connexion with locomotive repairs.

He is the author of numerous papers which have been read before the engineering societies, one of the best-known papers being the Autumn Lecture, 1923, of the Institute of Metals on "The Use of Non-Ferrous Metals in Engineering." His work for engineering has been acknowledged by his election to the presidency of the Institution of Locomotive Engineers (1912—14), the Institution of Automobile Engineers (1921), the Engineering Section of the British Association for the Advancement of Science (1923), the Institution of Mechanical Engineers (1926), and the Institute of Metals (1933). In addition he has held the Miller Prize, Telford Premium, Telford and Watt medals, and Webb prize of the Institution of Civil Engineers, and he has been honoured by the conferment of the LL.D. degree by Birmingham University and the D.Sc. degree by Manchester University.

During the war, before the Ministry of Munitions was formed, he was secretary to the Railway Companies' Munitions Sub-Committee, and upon the formation of the Ministry in June, 1915, was appointed director of production, and later superintendent of the Royal Aircraft Factory at Farnborough. He was also a member of the Advisory Committee on Aeronautics, and chairman of the Light Alloys Sub-Committee of this body, as well as a number of committees dealing with various aircraft work. He was awarded the C.B.E. in 1917 and created K.B.E. in 1918.

## INSTITUTE OF METALS

### Silver Jubilee Meeting

The Institute of Metals held its Silver Jubilee Autumn Meeting in Birmingham, from September 18—21, under the presidency of Sir Henry Fowler. The Institute was founded in Birmingham 25 years ago and it was appropriate therefore that the Conference was held in that city. The arrangements for the meeting were worthy of the historic occasion. They included on the technical side an inaugural lecture on "Twenty-Five Years' Progress in Metallurgical Plant," by Mr. W. R. Barclay, O.B.E., vice-president, a series of 14 papers dealing with various phases of metallurgical work, and visits to works of engineering and metallurgical interest. The social side of the proceedings included municipal and university receptions and a luncheon, as well as visits to places of interest in the Midlands, concluding with an all-day motor trip to the Cotswolds.

A specially interesting feature of the Conference was the reproduction of the first office of the Institute of Metals. This was located in the Metallurgical Department of Birmingham University and was set up by the Institute's first and only secretary, Mr. G. Shaw Scott, M.Sc., who, with the president and the chairman of the Executive Committee, received the remaining original members of the Institute in the reconstituted office. Here visitors had an opportunity of inspecting the earliest records of the Institute, including the original membership applications and the first letters to be typed on a machine which was shown to be still in working order, and photographs taken during the inaugural meeting in 1908. During Mr. Shaw Scott's 25-year period of office as secretary and editor the membership of the Institute has increased from 200 to 2,200. Whereas originally the membership was confined almost entirely to Great Britain, it now covers the whole world. The offices of the Institute were removed in 1909 to London, where the Institute is now located at 36, Victoria Street, Westminster, S.W.1.

The following are abstracts of the papers read at the meeting:

"The Constitution of the Silver-Rich Aluminium-Silver Alloys," by N. Ageew and D. Shoyket.—The constitutional diagram of the silver-rich aluminium-silver alloys has been determined by micrographic examination, *X*-ray analysis, and hardness measurements. The $\beta'$-phase ($Ag_3Al$) is converted on heating above 400° C. into a mixture of $\alpha$ and $\gamma$. The $\alpha$- and $\gamma$-phase boundaries at high temperature have been determined by precision measurements of the lattice parameter and by micrographic examination of the quenched alloys. The $\beta$-phase is stable only at high temperatures, and below 600° C. is converted into the $\alpha + \gamma$ eutectoid.

"Experiments in Wire-Drawing. III. Annealing of H.C. Copper Wires drawn to Varying Degrees of Hardness," by W. E. Alkins and W. Cartwright.—Silver-free h.c. copper of good quality (99·95% copper) was drawn into nominal No. 12 S.W.G. (0·104 in.) wire, intermediate annealing being introduced in such a way as to furnish 11 coils of wire varying in breaking load from 399 to 544 lb., and with reductions of area after annealing of from 36% to 97%. Samples were annealed for periods of ½, 1, 2, 6, 12, and 24 hr. at 130°, 155°, 170°, 180°, 205°, 230°, and 280° C., and for half an hour at 330°, 450°, 650°, 750°, and 850° C. Mean breaking loads after each heat-treatment, frequently and carefully checked, are published.

It is found that the annealing behaviour depends not so much on the original tensile strength of the wire as on the amount of reduction by cold-work which it has undergone; to express this in a form convenient for diagrammatic representation, the "work ratio"—diameter at intermediate annealing divided by final diameter—is used.

The more lightly drawn wires show an appreciable increase in strength after annealing at low temperatures. They retain their strength at temperatures up to, say, 250° C., very much better than the harder wires; the latter begin to soften at temperatures little above 100° C., and the rate at which strength is lost increases with increasing cold-work. The hardest wires all show a definite decrease in breaking load after storage for two years at room temperature; the more lightly drawn wires show no change. This apparent differentiation is again suggested by the breaking load/temperature curves from 450° to 850° C.; the lightly drawn wires decrease slightly but steadily in strength with rising temperature, but all the harder wires without exception have higher breaking loads after annealing at 750° C. and again at 850° C. than they have after heating at 650° C.

After all heat-treatments of sufficient severity to effect more or less "complete" annealing, the breaking load is lower the less the amount of cold-work done on the wire, and it increases steadily with increasing cold-drawing until the three most severely drawn wires of all are reached, when there are fairly definite indications of a decrease in the strength of the fully annealed wire.

The importance of these facts from the point of view of any theoretical discussion of annealing phenomena, and conversely in their bearing on the whole problem of hardening by cold-work, is evident.

"Further Observations on the Distribution of Porosity in Aluminium and Copper Ingots, with some Notes on Inverse Segregation," by N. P. Allen.—Three copper ingots and four aluminium alloy ingots cast in a specially tapered mould have been examined. In all cases the distribution of porosity followed the probable form of the isotherms in the cooling mass, and was much influenced by the mould taper. The type of microstructure also had an influence on the distribution of porosity, the nature of which is discussed. The inverse segregation of two aluminium–copper alloy ingots has been found to be closely related to their porosity.

"Magnesium Alloy Protection by Selenium and Other Coating Processes. Part II," by G. D. Bengough and L. Whitby.—Small losses of weight of Elektron alloy AZM (sheet) resulting from corrosion by immersion in, or spraying with, sea-water have been found to be associated with serious losses of elongation. Visual inspection did not suggest the extent of the damage, which occurred even when the alloy was protected by chemical coatings and paint.

"Properties of Some Temper-Hardening Copper Alloys containing Additions of Nickel and Aluminium," by H. W. Brownsdon, Maurice Cook, and H. J. Miller.—A study has been made of the effect of quenching and tempering on the properties of a number of copper alloys containing nickel and aluminium, and it has been found that when nickel, together with aluminium, are present in certain quantities and ratios, the hardness and other mechanical properties of the alloys are very considerably modified by the thermal treatment to which they are submitted. The alloys are softened by quenching from relatively high temperatures, and the quenched alloys, both in the soft and cold-worked conditions, harden considerably when reheated or tempered to an intermediate temperature somewhat below the annealing temperature. For a few typical alloys the changes in hardness and mechanical properties that can be brought about by suitable heat-treatment are given in some detail.

"Corrosion-Fatigue Characteristics of an Aluminium Specimen consisting of Two Crystals," by H. J. Gough and D. G. Sopwith.—An aluminium specimen consisting of two crystals has been tested under alternating torsional stresses in a slow stream of tap water; the main object of the experiment was to investigate the effect of an intercrystalline boundary on failure by corrosion-fatigue. The boundary was not attacked by the corrosive medium, nor did it influence in any visible manner the method of failure of the specimen, which took place primarily by the formation of cracks in areas undergoing heavy plastic deformation. On the surface of the specimen these cracks were generally parallel to the traces of the operative slip-planes; in several cases they had their origin at holes situated in the most highly-stressed regions; of the origin of these holes no definite evidence is available.

Whilst general attack in the form of oxide film and small pitting occurred throughout the duration of the experiment (about six weeks), this did not contribute to any appreciable extent to the failure of the specimen.

"Wear in the Polishing of Plated and Other Surfaces," by O. F. Hudson.—A series of tests was made in the laboratory of the British Non-Ferrous Metals Research Association to determine the comparative rates of wear of plates and other metal specimens under conditions of polishing as distinct from abrasion. The apparatus used is described, and the results obtained with the following materials are given, using magnesia on wet parchment as the polishing medium: pure platinum, pure palladium, platinum plating on brass, palladium plating ("soft," "hard," and burnished) on brass, nickel plating ("soft" and "hard") on brass, silver plating, and brass (60 : 40).

Considered as loss of thickness, the rate of wear of the palladium-plated specimens was found to be greater than that of the platinum-plated specimens, but considered as loss of weight, the wear of the palladium coatings was slightly less than that of the platinum coatings, whilst the precious metal coatings generally were more resistant than the same metals in massive form. Of the three types of palladium-plating, that in the "soft" condition showed the greatest wear, but the differences were not great; there was little difference in the rates of wear of the two kinds of nickel-plating. No definite or consistent relationship between hardness and rate of wear in polishing was revealed in these tests.

"A Graphical Method for Converting the Weight Percentage Compositions of Ternary Systems into Atomic or Molecular Percentages," by W. Hume-Rothery.—A graphical method is described for the conversion of the weight percentage compositions in ternary systems into atomic or molecular percentages, which is suitable for use where 60° ruled triangular paper is available. The method permits the direct transference of a triangular diagram drawn on the weight-percentage scale to one in atomic percentages, and the accuracy obtained is of the order 0·1% to 0·5%, according to the precision of the instruments and of the ruled paper.

"Notes on the Preparation of Lead and Lead Alloys for Microscopic Examination," by Brinley Jones.—A method is outlined for the rapid preparation of lead and tellurium–lead for low- and high-power examination.

Time devoted to preliminary polishing is restricted, the true structure of the metal being revealed by chemical solution of surface layers. After the removal of recrystallized layers, sections may finally be prepared for high-power examination by a treatment of alternate polishing and etching, the final polishing being vigorous.

"Precipitation-Hardening Nickel–Copper Alloys containing Aluminium," by D. G. Jones, L. B. Pfeil, and

T. Griffiths.—The properties of nickel-copper-...minium alloys with nickel contents from 10% to ... and aluminium contents up to 4% have been ...stigated. The relationships between composition ... capacity for hardening by heat-treatment have been ...ied by means of hardness tests on the heat-treated ...imens. A study has also been made of the most ...able heat-treatments to produce the soft condition, ... the stability at elevated temperatures of a selection ...he alloys in the precipitation-hardened condition. ...ally, the mechanical properties have been determined ... group of alloys selected and prepared in accordance ...h the results of the preliminary experiments.

In certain cases the properties of the 20% nickel alloys ...e studied in greater detail than those at other nickel ...ls, but sufficient work has been carried out on alloys ...ntaining 10%, 30%, and 45% nickel to enable the ...perties of alloys at these levels and over a range of ...minium contents, and in various conditions of heat-...atment, to be deduced.

"An Investigation of the Heat-Treatment of 'Stan-...d Silver,'" by H. O'Neill, G. S. Farnham, and F. B. Jackson.—The precipitation-hardening of ...enched "Standard silver" (7·25% copper) has been ...estigated by Meyer hardness analysis. Precision ...ray spectrograms obtained with Cu-radiation from ...k disc specimens of the heat-treated alloy indicate ...t surface preparation may considerably affect the ...tice parameter results. Polishing should be avoided ... this work, and etching may have bad effects. ...enched "Standard silver" when reheated for 30 min. ... the 300° C. region is in a sensitive condition, and ...pears to precipitate completely when deformed. If ...cautions are taken, the lattice parameters indicate a ...rmal progressive precipitation of copper constituent ... the quenched alloy is reheated at increasing ...nperatures.

"Some Steps in Metallurgical Progress, 1908—1933," ... W. Rosenhain.—The paper is a brief review of some ... the more important steps in metallurgical progress ...ring the 25 years of the existence of the Institute ... Metals. The matters touched on are those which ...ve been of particular interest to the author and have ...n in some degree associated with the Institute of ...tals. They include the following: age-hardening ...l the development of new alloys capable of improve-...nt by heat-treatment; Y-alloy and other casting ...oys capable of benefiting by heat-treatment; the ..."modification" of alloys; "aluminium-bronzes" and ...sses, the Durville and other special methods of casting ...ots or billets; metals of very high purity; alloys for ...ting tools—Stellite and sintered tungsten carbide; ...noval of gases from molten metals and alloys; the ...chanical behaviour of metals—slip, fatigue, plastic ...ormation; the study of metals by X-rays and by ...ctron diffraction; recent vindication of Beilby's ...pothesis of "amorphous" metal; corrosion and the ...ferential aeration theory; the protective surface ...n and its isolation; corrosion-fatigue.

"The Constitution of the Aluminium-Rich Alumin-...n-Copper Alloys above 400° C.," by D. Stockdale.—... part of the work of Dix and Richardson on the ...ubility of copper in aluminium has been repeated and their results have been closely confirmed. Alloys near the composition $CuAl_2$ have been examined in detail by the micrographic method. A considerable range of solid solutions has been found, but no evidence for the existence of the compound $CuAl_2$ has been obtained.

"Note on the Green Patina on Copper: Examples from Elan Valley (Wales) and Dundalk (Ireland)," by W. H. J. Vernon.—The patina from a copper structure in mid-Wales contained 20·75% basic copper chloride, as compared with 8·15% in the patina from a copper spire at Dundalk, on the east coast of Ireland (approximate ratio 2·5 : 1): *this result is attributed to the* influence of prevailing winds. Basic copper sulphate constituted the bulk of the deposit in each case, relationship of formula with period of exposure confirming the conclusions of previous work.

## CORRESPONDENCE

### THE DISCOVERY OF FORMIC ACID

SIR,—Since the time of Kopp (Geschichte der Chemie, 1847, iv, 362) it has generally been stated that formic acid was discovered by John Wray in 1670, the discovery being made about the same time by a German, Samuel Fischer, in the juice expressed from ants or in the liquid obtained by distilling ants (Kopp, *op. cit.*; "genauere Auskunft über diese Angabe habe ich mich nicht verschaffen können"; Lippmann, Zeittafeln zur Geschichte der organischen Chemie, 1921, 3). The actual facts are as follows. In a letter to the Philosophical Transactions of January 13, 1671, John Ray (1628–1704), the famous English naturalist, gives an account of an experiment which "some years since Mr. Samuel Fisher of Sheffield" (*born in Northampton; died 1665*) made him acquainted with, "viz., If you stir a heap of ants so as to rouse them, they will let fall on the instrument you use a liquor, which if you presently smell to, will twinge the nose like newly distilled spirit of vitriol. . . . Ants distilled by themselves, or with water, yield a spirit like spirit of vinegar, or rather like the spirit of *viride aeris* [*strong acetic acid distilled from copper* acetate]. Lead put into this spirit, or fair water, with the animals themselves being alive, makes a good saccharum saturni [lead formate]: Iron put into the spirit, affords an astringent tincture, and by repetition a crocus martis. Take the saccharum saturni thus made, and distil it, and it will afford the same acid spirit again, which the saccharum saturni made with vinegar will not do, but returns an inflammable oil with water, and nothing that is acid" (Phil. Trans., abridged ed., i, 556).

I am, Sir, etc.,
J. R. PARTINGTON

East London College, E.I
Sept. 14, 1933

### MODERN FOOD PROBLEMS

SIR,—The chemist is paying increasing attention to food, and some of his activities are having most undesirable reactions. It is becoming increasingly impossible to obtain fresh vegetables and fruit in hotels and restaurants, even in the height of their respective seasons. How often is one served with tinned grapefruit, tinned soup, tinned vegetables, and tinned fruit at

one and the same meal? A hydro in Harrogate of all places served tinned celery on August Bank Holiday, and an accidental view of its stores *en route* to the garage revealed stacks of nothing but tinned goods. Now CHEMISTRY AND INDUSTRY is telling us what a perfect food for adults milk is. May I ask the food experts if milk is a perfect food for adults how is it that nature only supplies it in infancy? May I venture to assert that milk is extremely constipating to many adults, and therefore the cause of much indigestion and auto-intoxication with its attendant evils.

I am, Sir, etc.,

C. M. WHITTAKER

Cheadle Hulme,
Cheshire
Sept. 18, 1933

## DETECTION AND ESTIMATION OF THE BARIUM GROUP PRESENT AS SULPHATES IN SILICATES

SIR,—In the rapid determination of the barium group present as sulphates in silicates, it must not be forgotten to extract the water soluble sulphate from the fusion before treatment with acid. By omitting this precaution, the $SO_4$ ions are recombined, precipitated, and filtered off.

I am, Sir, etc.,

E. H. L. CANNON

Newark, Notts
Sept. 18, 1933

## PERSONAL AND OTHER ITEMS

Dr. Herbert Levinstein, vice-president of the Society, is to give the Fifth Gluckstein Memorial Lecture at the Institute of Chemistry on Friday, December 15, at 8 p.m.

It was a pleasure to receive this week a visit from the hon. treasurer of the American Section. Mr. J. W. H. Randall is making a round trip largely for the sake of his health and is accompanied by Mrs. Randall who made many friends among the members on the occasion of the Jubilee Celebrations in 1931. Mr. Randall's stay is necessarily short and he will be unable to meet all his old friends here, but wishes to be specially remembered to those he met on the occasion of the Society's visit to New York in 1928.

The Council of the Institute of Chemistry has appointed Mrs. Janet Matthews, Ph.D., D.Sc., to be the Third Pedlar Research Scholar. Mrs. Matthews is to work at the Imperial College of Science, London, on the development of inorganic microchemical analysis with special reference to gravimetric work requiring separations.

Mr. M. D. Curwen, B.Sc., who for a long time has been the editor of *The Industrial Chemist* has relinquished this post and has set up as consultant chemist at 625, Grand Buildings, Trafalgar Square, London, W.C.2. His telephone number is Whitehall 4944.

Mr. R. P. Lamont has resigned from the presidency of the American Iron and Steel Institute, and it is reported that he will be succeeded by Mr. Charles Schwab, who was the president last year. It is suggested in America that Mr. Lamont is not in sympathy with the industrial policy of the National Recovery Administration in America.

**Food Group**

The Food Group of the Society has made arrangements to hold a symposium on the subject of "Bread and Milk" on Thursday and Friday, November 23 and 24, 1933, in the hall of the British Medical Association, Tavistock Place, London, W.C.1. The symposium will be of an international character and aims at bringing together scientific knowledge of the two important foodstuffs, bread and milk. Many prominent scientists from this country and abroad have been invited to contribute to the proceedings. They include Prof. Dr. J. R. Katz (Amsterdam), Prof. Kluyver (Delft), Dr. Birchard (Canada), Dr. Bungenburg de Jong (Utrecht), Herr Brabender (Duisberg), Prof. Orla Jensen (Copenhagen), Prof. Sörensen (Copenhagen), Prof. Rob. Burri (Berne), Dr. G. S. Wilson, Dr. E. T. Minett, Prof. J. C. Drummond, Prof. H. D. Kay, Dr. J. V. Eyre, Dr. D. W. Kent-Jones, Prof. J. B. Haldane.

Three sessions will be held, at which about 14 papers will be presented. Prof. W. W. Jameson, M.D. has kindly promised to open the symposium and preside at the first session. Sir John Russell, F.R.S. will preside at the second and Prof. H. E. Armstrong, F.R.S. will preside at the third meeting. The symposium will terminate with a dinner to be held at the Trocadero Restaurant, at which Dr. L. H. Lampitt will take the chair and Sir Hilton Young, Minister of Health, will be the chief guest.

All members of the Society may attend the symposium and other persons by invitation. Non-members who wish to be present should notify the general secretary. Rooms will be reserved for the use of members and visitors at the Hotel Russell, Russell Square, W.C.1. (Application must be made to Prof. H. Raistrick, hon. secretary of the Food Group.)

**Chemical Engineering Group**

The opening meeting of the 1933—34 session of the Chemical Engineering Group will take place at 8 p.m. on Thursday, October 12, in the rooms of the Chemical Society, Burlington House, Piccadilly, London, W. The subject to be dealt with is "The Canning of Fruit and Vegetables," one of very great and increasing importance to the economic welfare of a large section of the country. A paper will be presented by Mr. George Cadbury, of the well-known Bournville firm, who is also chairman of British Canners, Ltd. A practical and up-to-date handling of the subject is therefore assured together with the stimulation of a full and interesting discussion. A cordial invitation is extended by the chairman and committee of the Chemical Engineering Group to members of the London Section and of the Food Group to attend and to speak.

**Institute of Fuel**

The Institute of Fuel announces that Dr. Ing. H. Koppers is unfortunately unable to present the paper on "Recent Developments in Coking Practice" on October 18, as was announced previously. A meeting however will be held in the Lecture Theatre of the Geological Society, Burlington House, Piccadilly, W.1 on October 18 at 2.30 p.m., when Dr. E. W. Smith will open a discussion on this subject, to be followed by Dr. G. E. Foxwell and others. The most recent developments of both high- and low-temperature coking practice

be dealt with by the openers of this discussion. The Council of the Institute extends an invitation to the members of other societies. No tickets for admission will be required.

**Natural Colouring Matters**

In the editorial "Natural Colouring Matters" in last week's issue of the JOURNAL, in commenting on the paper presented by Prof. R. Kuhn at the meeting of the British Association it was stated that there were no headlines in the press report nor indeed any report at all. It is pleasing however to find that this was not entirely correct for the *Manchester Guardian* in a survey of the Leicester Meeting on September 14 drew particular attention to Prof. Kuhn's paper, which is described as perhaps the most impressive of those given at this year's meeting.

**Northampton Polytechnic Institute**

The Northampton Polytechnic, St. John Street, London, E.C.1, has published a booklet giving particulars of day and evening courses in applied chemistry during the 1933–34 session which commences on September 25. The Department of Applied Chemistry has been transferred to the additional polytechnic buildings recently erected on a site facing St. John Street. The department here occupies the first and second floors, and comprises a number of well-appointed lecture rooms and laboratories. Separate laboratories are provided for elementary and advanced general chemistry, electrochemistry and deposition, fuels, metallurgy, and metallography, the whole representing a noteworthy development of facilities for instruction in those branches of pure and applied chemistry with which the teaching of the department is associated. Copies of the booklet can be obtained on application to the principal of the Polytechnic.

## COMPANY NEWS

### MUREX, LTD.

The directors of the company, which holds all the shares of Murex Welding Processes, Ltd. and Pure Metal Manufacturing Co., Ltd. recommend a final dividend of 20%, less tax, on the ordinary shares, making a total of 30%, as against 35% last year. The dividend is payable on October 6 to shareholders registered on September 27.

### INTERNATIONAL COMBUSTION, LTD.

It is announced that the shares held by International Combustion Engineering Corporation, of New York, in International Combustion, Ltd. of Aldwych House, Aldwych, London, W.C.2, have been acquired by English interests. No shares are now held in the United States.

### INTERNATIONAL NICKEL CO. OF CANADA

The directors of the company have announced a quarterly dividend of 7% per annum on par value of preferred stock payable on November 1 to shareholders registered on October 2.

### INTERNATIONAL PAINT & COMPOSITIONS CO., LTD.

The company has announced an interim dividend of % on the preference and ordinary shares, payable on September 30. This is at the same rate as last year, when the final dividend brought the total to 9%.

## MARKET REPORT

**This Market Report is compiled from special information received from the manufacturers concerned.**

*Unless otherwise stated, the prices quoted below cover fair quantities net and naked at sellers' works.*

The following alterations in prices are reported since the publication of the last Market Report (cf. CHEM. & IND., Sept. 1, p. 702, 1933).

### TAR PRODUCTS

**Acid Carbolic.—Crystals.**—9d.—10d. per lb. Crude 60's, 2s. 5d.—2s. 6d. per gal.

Acid Cresylic, 99/100.—1s. 6d.—1s. 8d. per gal. Refined, 1s. 8d.—1s. 9d. per gal. Pale, 98%, 1s. 4d.—1s. 5d. per gal. 95%, 11d.—11½d. per gal. Dark, 10d. per gal.

**Naphtha.—Solvent**, 90/160, 1s. 4d.—1s. 5d. per gal. Solvent, 95/160, 1s. 8d. per gal. Solvent 90/190, 11d.—1s. 1d. per gal.

**Naphthalene.—Purified crystals, £9 10s. per ton in** bags. Crude, Hot Pressed, £6 5s. per ton.

Pyridine.—90/140,—4s. 3d.—5s. 6d. per gal.; 90/180—2s.—2s. 3d. per gal.

### ESSENTIAL OILS

*Citronella Oil.*—Java, 2s. 6d. per lb. Ceylon, 2s. 3d. per lb. Clove.—90/92% English, 4s. 3d. per lb.

**Eucalyptus, Australian B.P.**, 70/75%.—1s. 2d. per lb. Lavender.—Mont Blanc, 38/40%.—12s. 9d. per lb. Lemon.—5s. per lb. Lemongrass.—4s. per lb. Orange, Sweet.—6s. 6d. per lb. Otto of Rose.—Anatolian, 33s. per oz.; Bulgarian, 45s. per oz. Palma Rosa, 8s. per lb.

Peppermint.—Japanese, 5s. per lb. Wayne County, 13s. 6d. per lb. Petitgrain.—4s. 9d. per lb.

## PATENT LIST

*The following is a list of complete specifications of chemical interest which* **are open for inspection under Section 91 (4) (*a*) of the Patent Acts. Printed copies are not available, but photographic copies may be obtained at a charge of 8d. per page (minimum 1s.) from the Patent Office, Chancery Lane, W.C.2.**

**I.** 3482 (1933). Bowser & Co. Purifying liquids.

6304—5 (1933). Krupp Grusonwerke. Multiple-chamber grinding mills.

**II.** 3014 (1933). Gulf Refining Co. Manufacture of heavy lubricating oils.

6788 (1933). N. V. voor Keramische en Chem. Ind. Kero-Chemica. Production of mean-temperature coke.

**III.** 6031 (1933). Darrasse, Darrasse, Dupont, and Elöd. *See* XX.

6113 (1933). I. G. Farbenind. Manufacture of sulphonation products.

6144 (1933). I. G. Farbenind. Process for the manufacture of reaction products.

6374 (1933). I. G. Farbenind. Manufacture of nuclear substitution products of acenaphthalic acid and 1 : 4 : 5 : 8-naphthalenetetracarboxylic acid.

6437 (1933). I. G. Farbenind. Manufacture of reaction products.

6541 (1933). I. G. Farbenind. *See* XII.

21,744 (1933). I. G. Farbenind. Manufacture of acid amide derivatives.

**IV.** 6114 (1933). I. G. Farbenind. *See* VI.

**V.** 22,323 (1932). Wacker Ges. f. Elektrochem. Ind. Dry cleaning.

6375—8 (1933). I. G. Farbenind. Manufacture of artificial silk.

**VI.** 5555 (1933). Soc Chem. Ind. in Basle. Dyeing viscose artificial silk piece goods.

6114 (1933). I. G. Farbenind. Manufacture of a monoazo dyestuff on the fibre.

**VII.** *36,117 (1932). Hene. Production of alkali thiocyanates*, alkali ferrocyanides, or Prussian blue.

5829 (1933). Mathieson Alkali Works. *Production of* water-soluble metal carbamates

**VIII.** 6083 (1933). Oesterr. Amerikan. Magnesit A.-G. *Production of magnesite blocks of high resistance to* changes of temperature.

**X.** 35,425 (1932). Goodyear Tire & Rubber Co. Bond*ing of metals with rubber.*

1977 (1933). Aluminium, Ltd. Heat-treatment of easily-oxidizable metals

4171 (1933). Krupp Grusonwerke. Sintering fine ores etc.

24,501 (1933) Angelini. Preparation of iron or steel containing chromium.

**XII.** 6541 (1933) I. G. Farbenind. Manufacture of reaction products from natural or synthetic waxes of the ester type.

**XIII.** 36,117 (1932). Hene. *See* VII.

6258 (1933). I. G. Farbenind. Luminous paints, moulded articles, coatings, or lacquers.

6259 (1933). Accumulatoren-Fabr. *See* XIV.

**XIV.** 35,425 (1932). Goodyear Tire & Rubber Co. *See* X.

6259 (1933). Accumulatoren-Fabr. Manufacture from aqueous rubber dispersions of a highly-viscous substance capable of being shaped, applied with a brush, or sprayed

6542 3 (1933). I. G. *Farbenind. Vulcanization of* rubber.

**XIX.** 6559 (1933). Navrotzky. *Recovery of alcohol from bread-baking ovens.*

**XX.** 6031 (1933). Darrasse, Darrasse, Dupont, and Elod. Manufacture of bornyl oxalates.

6132 (1933). I. G. Farbenind. Manufacture of therapeutic media.

**XXI.** 6115 7 (1933). I. G. *Farbenind Screens for* half-tone processes.

6257 (1933). I. G. Farbenind. Anti-halation layers for photographic plates and films.

**XXIII.** 3482 (1933). Bowser & Co. Purifying liquids.

## GENERAL NOTES

### Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific number. *Argentina:* Paints, linseed oil (B.Y. 7657). *Belgium:* Rayon (296). *Brazil:* Water purification plant (G.Y. 12,949). *British India:* Permanganate of potash (282). *British West Indies:* Perfumery (283): Artificial silk (284): Asbestos cement, corrugated iron, earthenware (285). *Egypt:* Leather, varnishes, paints, dry colours (28,644/33). *France:* Foodstuffs (298). *Hungary:* Drugs, patent medicines (F.Y. 1853). *India, Burma, and Ceylon:* Patent foods, medicines, toilet preparations, polishes (289). *New Zealand:* Chemicals (291). *Norway:* Cotton waste (300). *Rumania:* Cutlery (301). *South Africa:* Steel (G.Y. 12,953 and G.Y. 12,951); Pig iron (G.Y. 12,954): *Carbide of calcium* (F.Y. 1858); Steel, tools, corrugated iron (292). *Spain:* Scientific and optical instruments (B.Y. 7652). *Sweden:* Tinplate, hematite pig iron (G.Y. 12,948). *Tunisia:* Rubber (G.Y. 12,957 and F.Y. 1857).

### Key Industry Duty

The question of the renewal of the Safeguarding of Industries (Exemption) Orders, Nos. 1 and 2, 1932, and Nos. 1 and 2, 1933, made under Section 10 (5) of the Finance Act, 1926, are now under consideration by the Board of Trade. The articles covered by these Orders, which exempt them from duty until December 31, 1933, are:

Acids adipinic, isobutylallylbarbituric, carbolic (synthetic), oxalic, and propionic; amidopyrin; ammonium perchlorate; amorphous carbon electrodes over 3 ft. × 1 ft. × 1 ft.; barbitone (veronal etc.); bromural; butylmethyl adipate; calcium gluconate; celtium oxide; quinoline; chinosol; cocaine, crude; dial; dicyandiamide; didial (ethylmorphinediallyl barbiturate); dimethyl sulphate; diphenyl; diphenyl oxide; dysprosium oxide; elbon (cinnamoylparaoxyphenyl urea); erbium oxide; ethyl abietate; ethyl cellulose; ethylene bromide; eukodal; europium oxide; furfurol; gadolinium oxide; germanium oxide; glycol ethers; guaiacol carbonate (duotal); holmium oxide; integrators (planimeter type) R. lead acetate; lead tetraethyl; lipoiodin; lutecium oxide; mercury vapour rectifiers having mercury cathodes; metaldehyde; methyl cellulose; methylcyclohexanolmethyl adipate; methyl sulphonal; methylene chloride; neodymium oxide; nickel hydroxide; oxymethylparaoxyphenylbenzylaminemethyl sulphate; papaverine; phenazone; paraphenetidine; phloroglucine; photogravure screens exceeding 40 in. in length; phytin; piperazine; planimeters; R. potassium chlorate; potassium ethylxanthogenate; potassium guaiacol sulphonate; R. potassium hydroxide; R. potassium permanganate; praseodymium oxide; pyramidon-veronal; quinine ethylcarbonate; radium compounds; phenyl salicylate; samarium oxide; scandium compounds; sodium ethylmethylbutyl-barbiturate; strontium carbonate; strontium nitrate; styracol; sulphonal; synthalin; terbium oxide; thulium oxide; urea; vanadium-silica compounds specially prepared for use as catalysts for sulphuric acid manufacture; ytterbium oxide; yttrium oxide.

Any communication should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, London, S.W.1, before October 12, 1933.

## PUBLICATIONS RECEIVED

THE THYROID GLAND: ITS CHEMISTRY AND PHYSIOLOGY. By C. R. Harington, F.R.S. Pp. xii + 222. London: Oxford University Press, 1933. 15s.

RECORD OF THE SCIENTIFIC WORK OF SIR JAMES DEWAR. Pp. 68. London: Chiswick Press, 1933.

TANNIN, CELLULOSE, LIGNIN. By Dr. K. Freudenberg. Together with 2nd edition of "Chemie der Natürlichen Gerbstoffe." Pp. iv + 165. Berlin: J. Springer, 1933. 8.80 rm.